GoldenGate®

High Availability and Disaster Recovery

Modern Considerations and Options

NYOUG Meeting – June 6, 2006

Agenda

- Introduction
- High Availability - 2006
- Industry Shift from MTTF to MTTR, Continuous Availability
- Challenges in HA environments
- Understanding/Evaluating HA technologies
- TDM HA Solutions
- Questions & Answers

Speaker Introduction/Background

- **Chris Lawless**
  - Open Systems Technical Lead, GoldenGate Software
    - Software Analyst for GoldenGate's Technical Services team
    - Top instructor in helping users implement high availability and real-time data integration solutions for a variety of databases running on Windows and UNIX platforms
  - Senior Database Instructor for Oracle Corporation
    - 2003 Oracle's DBA West "Instructor of the Year" award
    - Oracle's "Gold Club" award by consistently achieving customer satisfaction ratings exceeding 95.5%

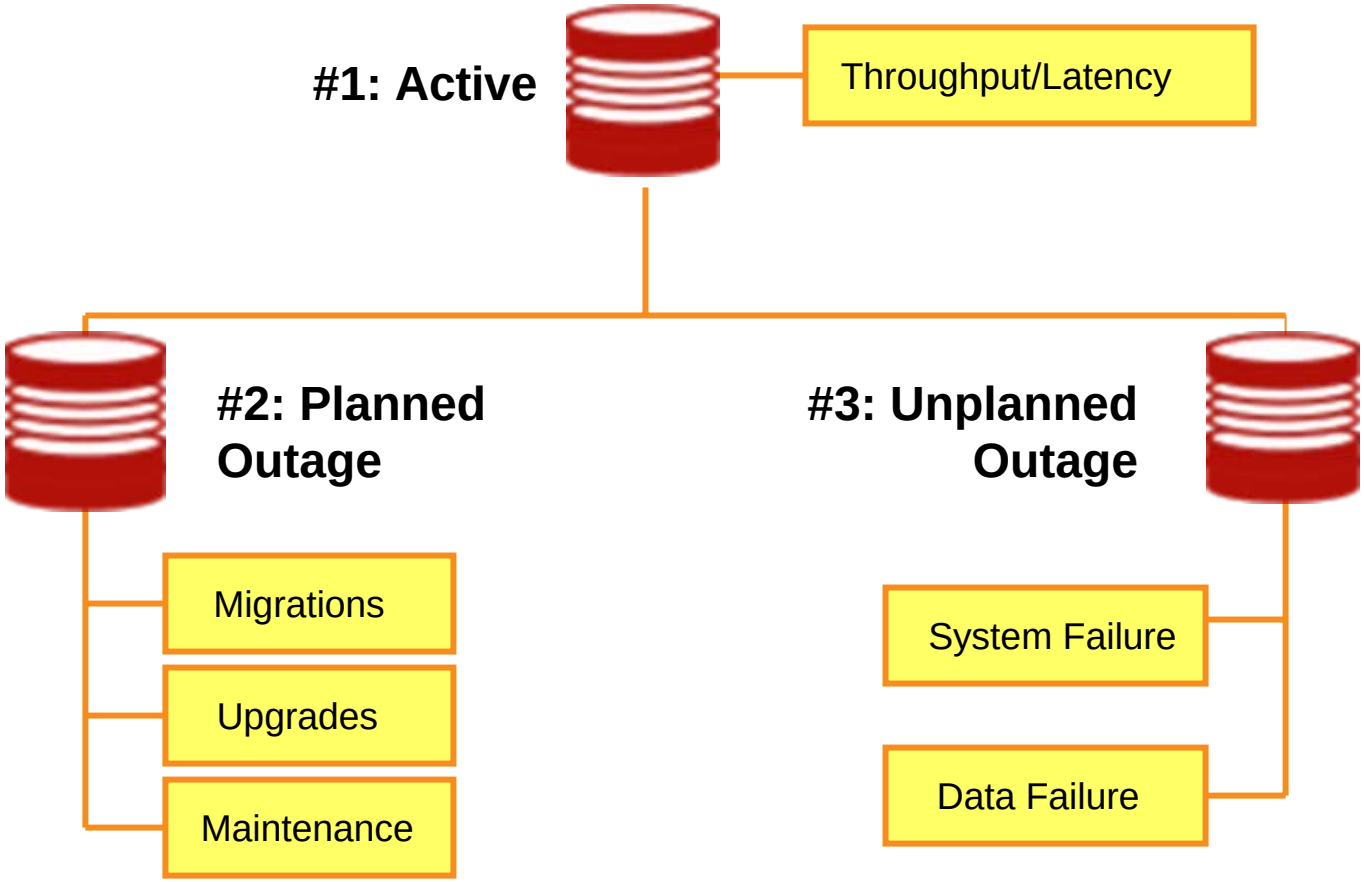
HA (2006)

- **Definition**
  - Ratio of system uptime to sum of uptime and downtime

    Availability = MTTF/(MTTF+MTTR)

- **Challenges**
  - Addressing Performance vs. Reliability in computer systems
  - Hardware Faults, Software Bugs, Human errors are realities in any complex system deployment
  - Enterprise applications need to function 24x7
  - Disasters are no longer a distant threat
  - Inadequate planning to handle outages

The 3 States of Availability: Systematic View



High Availability Concerns (No Outage)

#1: Active

Throughput

- Latency
- DSS vs. OLTP conflicting requirments
- Mixed workload
- Data validation
- Data transformation

Common Approaches

Add more…

- Nodes
- Resources
- Infrastructure

High Availability Concerns (Planned Outages)

#2: Planned Outage

- Migrations
- Upgrades
- Maintenance

Common Approaches

- Selected windows of downtime
- Phased approach to maintenance

High Availability Concerns (Unplanned Outages)

Common Approaches

- Database Restore/Recovery
- RAID
- Shared Disk Clusters
- Standby database

#3: Unplanned Outage

- System Failure
- Data Failure

Evaluating HA Technologies

- Availability
  - Is the Failover/DR solution available for real use?
- MTTR (RTO)
  - In the event of a failure, how soon can the data be recovered?
- Performance
  - Speed and support for high volumes
- Data Loss (RPO)
  - What is the impact of an unplanned outage in terms of lost data?
- Zero downtime
  - Does the solution allow for zero downtime during planned outages?
- Manageability
  - Configuration, Install, Monitoring
- Impact on deployed systems
  - How intrusive? What is the impact on data itself?
- Cost
  - Licensing, maintenance

Differentiating HA Technologies

- Conventional Backup/Recovery
- RAID
  - multiple hard disks behaving as a single large fast drive (mirrors/stripes/duplexing/parity)
- Snapshots

Roll Forward / File Protection

- Block Level Database Replication
- Change Level Database Replication
- Remote Mirroring Solutions
- Transactional Data Management

High Availability and Disaster Recovery

HA Technologies & Tradeoffs

- **Block based database replication**
  - Standby kept in constant recovery (mount) mode
    - Useful for strict disaster recovery only, not HA
    - Cannot be used for reporting in recovery mode
    - No write access for distributed load balancing
    - Application response times suffer after failover
    - Cannot address availability across heterogeneous systems
- **Change based database replication**
  - Trigger or log based
    - Not optimized for real time performance
    - Intrusive, Complex
    - Cannot address availability across heterogeneous systems

HA Technologies & Tradeoffs

- **Remote mirroring solutions**
  - Volume managers maintain mirrors of local writes on a set of remote volumes
    - Useful for file protection
    - Physical distance to remote volumes is a critical limitation
    - No protection from logical corruption, or storage stack corruption
  - **Message based** logical writes sent by primary host over IP to remote hosts (synchronously/asynchronously)
    - Write ordering must be maintained by primary host
    - Remote volumes are standby-only, applications cannot access them
    - No protection from logical corruption
  - **Hardware based**
    - Storage arrays propagate IOs to storage arrays at a secondary site
    - Secondary arrays are inaccessible during replication
    - No protection from logical corruption
    - Only useful for block availability during DR

Oracle: Technologies & Tradeoffs

- **RAC**
  - Good for protection from system failures
  - Shared disk architecture can result in single point-of-failure
  - Complex deployment, no protection from media failure

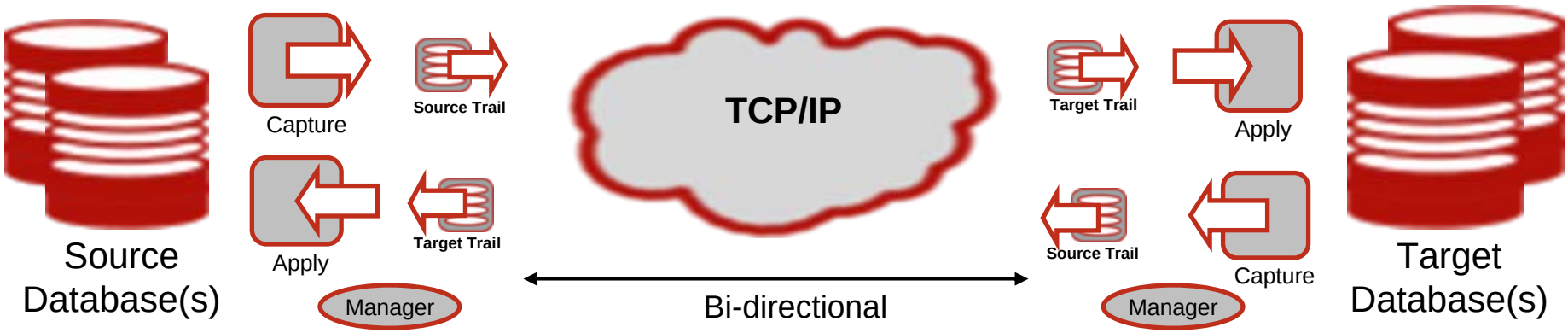
- **Data Guard**
  - **Physical standby**
    - Runs in inactive mode (mounted)
    - Cold cache increases MTTR from transactional standpoint
    - Network latency (over SQL*Net)
    - Media recovery process lags significantly during heavy workloads
  - **Logical standby**
    - Redo/Archive logs shipped over the network to standby site
    - Real time reporting, High throughput workloads (9i limited support)
    - Vulnerable to data loss (9i)
    - RTA – Performance impact on LGWR
    - Read Only access for data set being logically protected

Oracle: Technologies & Tradeoffs

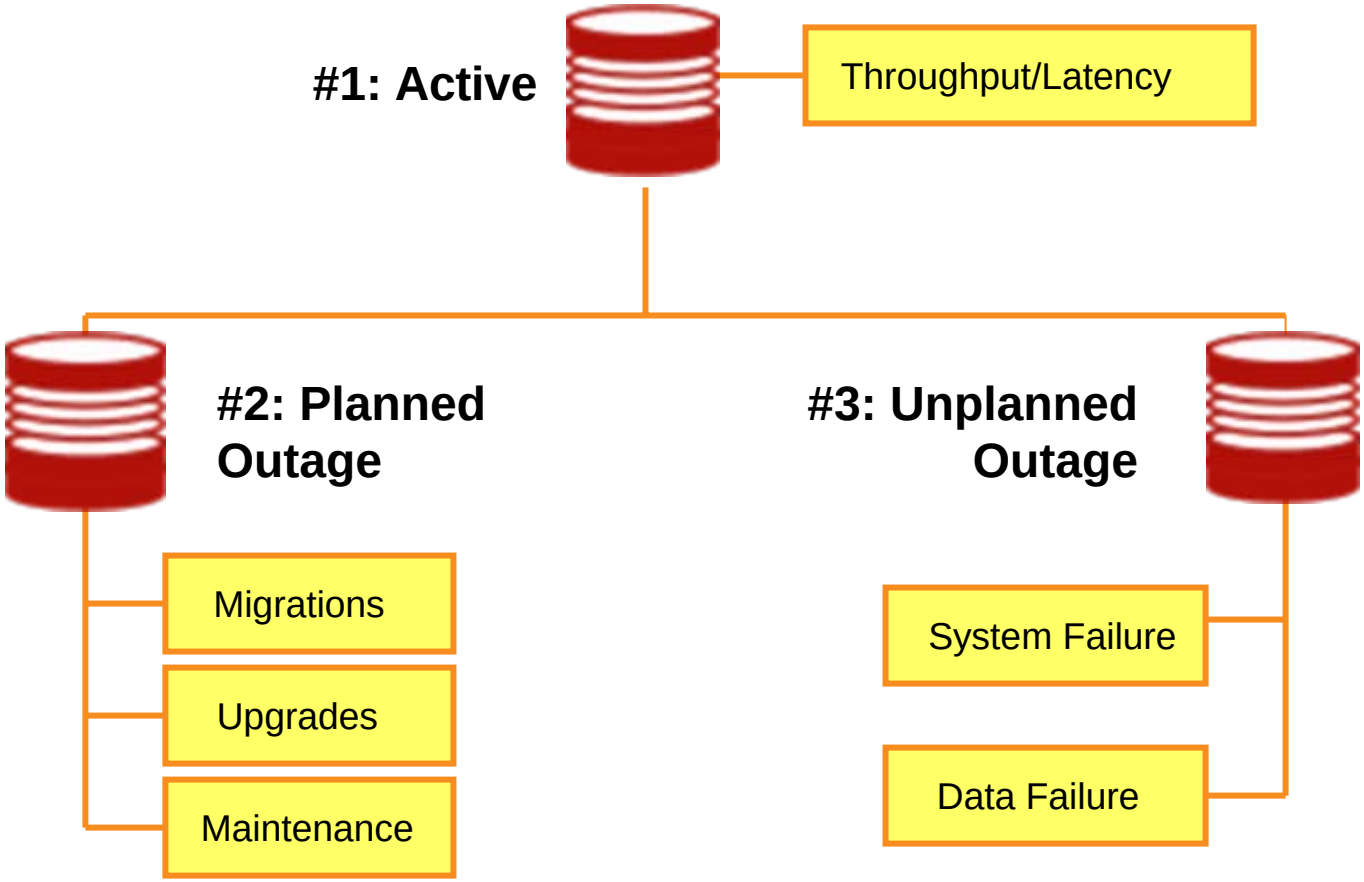
- **Streams**
  - Good for information sharing in low to moderate throughput environments
  - Allows Oracle databases to be on different platforms
  - Limited support for datatypes in pre 10g release
  - Metadata managed within database
  - Requires custom application for capture from non-Oracle database

HA Technologies & Tradeoffs

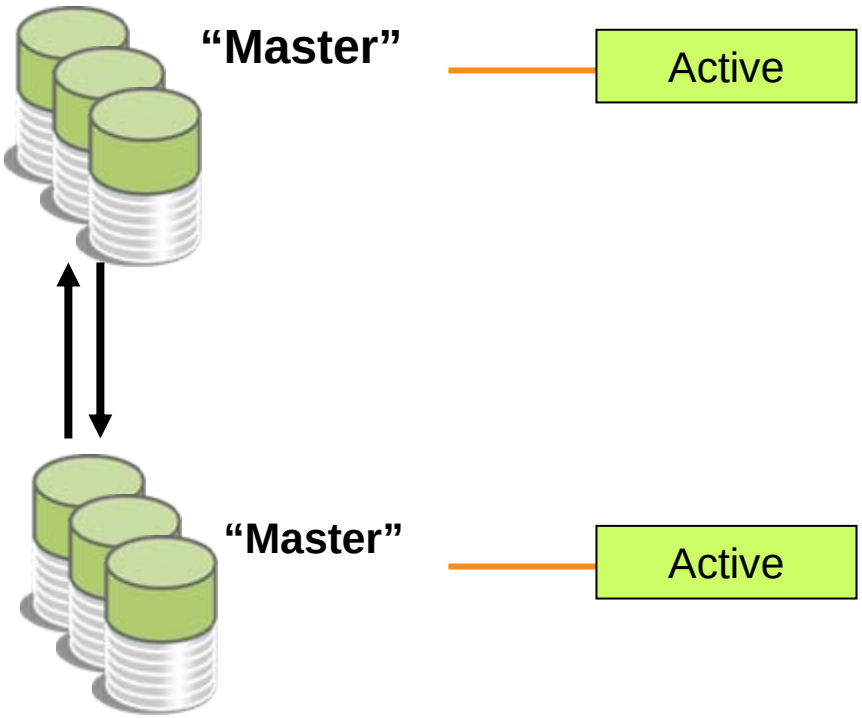
- **Transactional Data Management**
  - Captures, transforms, routes, and delivers data transactions in real time across heterogeneous environments
    - Data integrity, low impact/overhead, high volume
    - Many use cases for HA, DR, data integration, live reporting, data warehousing, distributed computing
    - Not for file-level replication



HA/DR: Solution Examples



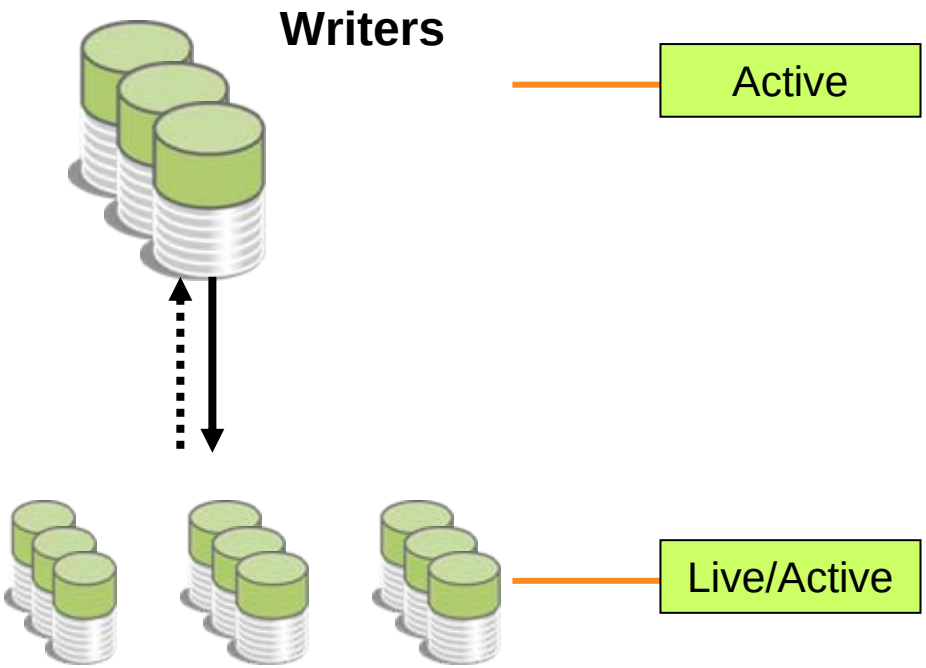
HA Configuration: Multi-Master



- Bi-directional configuration – dual-master for load balancing, improved performance and throughput
- **For…**
  - Highest Availability
  - Maximized ROI on hardware (transaction balancing)
- **Example areas:**
  - 24x7 (ATMs, Online Banking)
  - Online Retail

Bank of America

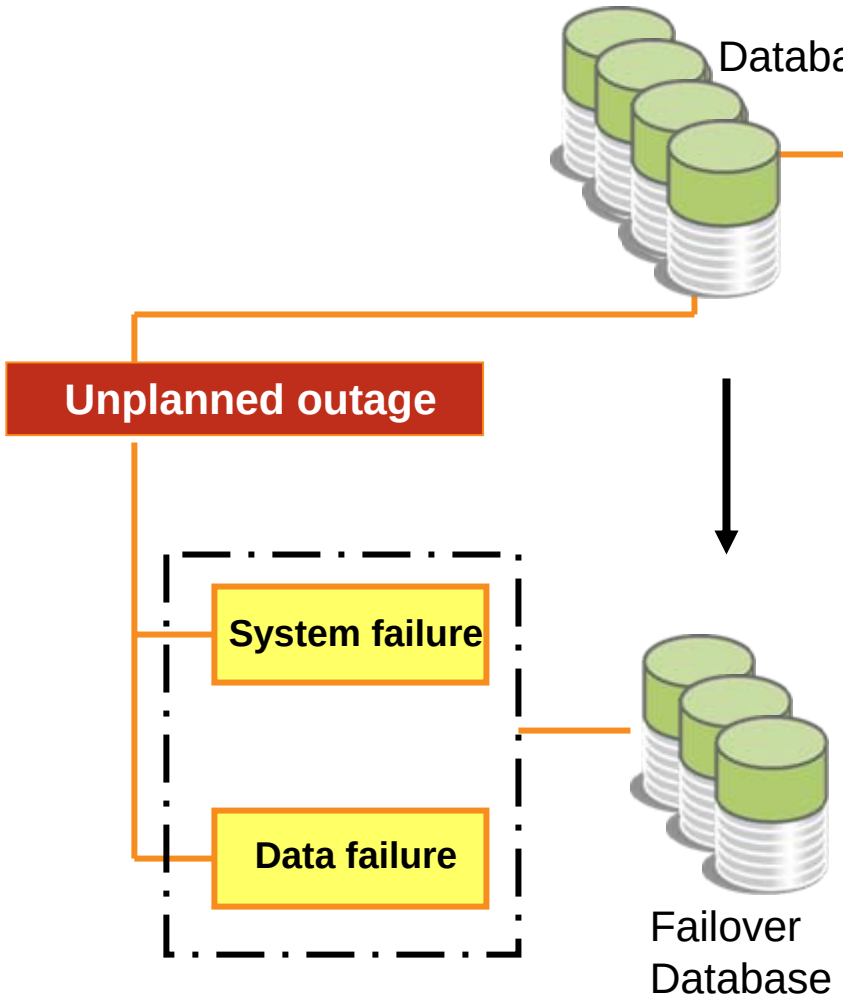
HA Configuration: Scalability



- Improve scalability and performance of transaction processing by offloading query load to lower-cost databases/platforms
- **For…**
  - Horizontal scalability
  - Improved performance
- **Example areas:**
  - Online Reservations
  - Online Lookups

Sabre Holdings

HA Configuration: Disaster Tolerance



- An HA implementation that captures and applies data to a failover system in real time.

- **For…**
  - Fast failover (No restore)
  - Do root-cause analysis later!
  - Surgical Repair (Dynamic, Selective undo)

- **Example areas:**
  - 24x7/mission-critical applications
  - Strict SLA requirements

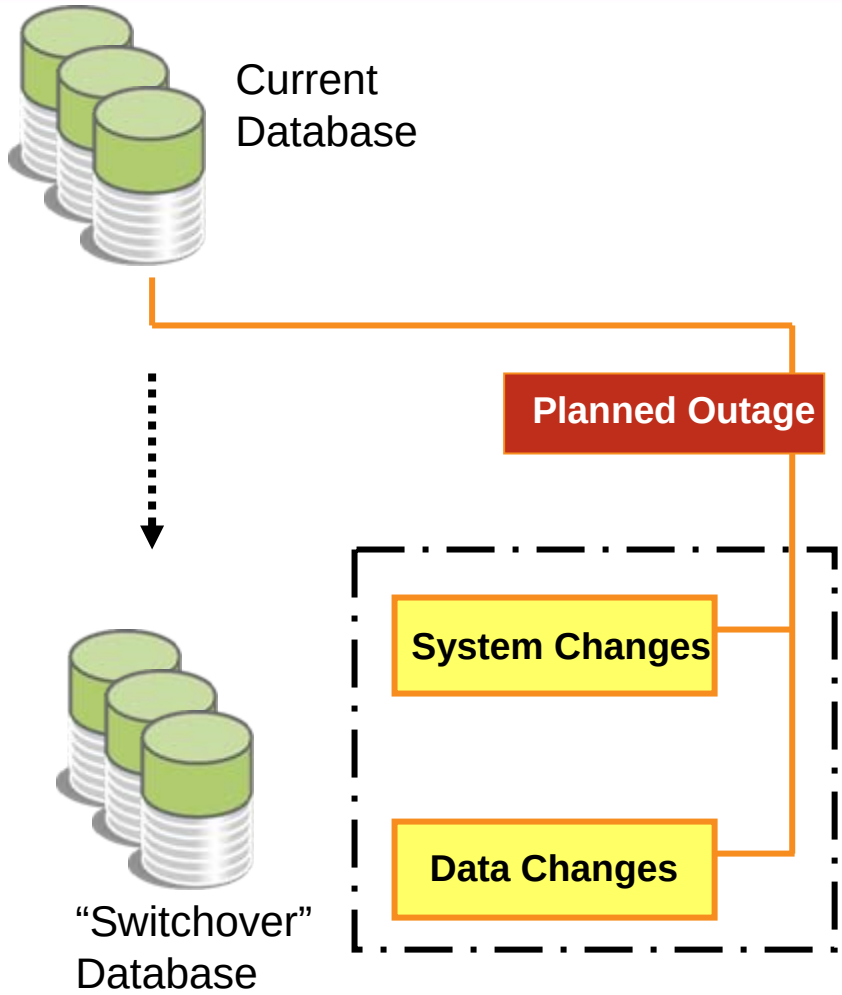
MONTEFIORE Medical Center

HA Configuration: Switchover

- Zero-Downtime Migrations
- Rolling Upgrades
- Zero-Downtime Maintenance
- Failback contingencies

- **For…**
  - 24x7 availability
  - Reduced windows for system maintenance

- **Example areas:**
  - Can't afford downtime to do in-place upgrade



About GoldenGate Software

GoldenGate Software is a privately held software company that offers Transactional Data Management solutions.

Established, Loyal Customer Base

250 customers... 1500+ solutions implemented… in 35 countries

Leading Industry Solutions

18,000 Node ATM Network with 24/7 Availability

Achieving paperless enterprise for this visionary healthcare provider

Saving $ millions with real-time DW and zero downtime migrations.

Database tiering handles average of 300,000 updates/hour, peaks at 800,000/hour

GoldenGate®

Thank You. Q&A

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